

## 2.1b The Sandwich Theorem

Estimate  $\lim_{x \rightarrow 0} (x^2 \sin \frac{1}{x})$  Use graphical and numerical methods

related problem  $\lim_{x \rightarrow 0} \sin \frac{1}{x} = \text{dne}$   
oscillations

$$f(x) = x^2 \sin \frac{1}{x}$$

$$\lim_{x \rightarrow 0} x^2 \sin \frac{1}{x} = 0$$

$$-1 \leq \sin \frac{1}{x} \leq 1$$

$$-x^2 \leq x^2 \sin \frac{1}{x} \leq x^2$$



p65 The Sandwich Theorem

Aug 30-8:07 PM

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Graph the following functions:

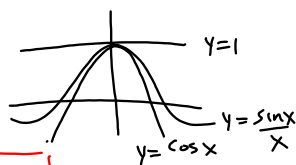
$$y = \cos(x) \leq y = \frac{\sin(x)}{x} \leq y = 1$$

$$\lim_{x \rightarrow 0} \cos x = 1$$

$$\lim_{x \rightarrow 0} 1 = 1$$

How does this support

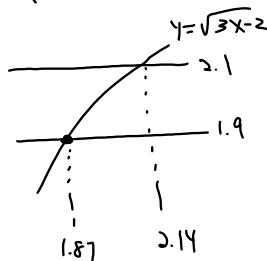
$$\lim_{x \rightarrow 0} \frac{\sin(x)}{x} = 1$$



How close should  $x$  be to 2 so that  $f(x) = \sqrt{3x-2}$  is within .1 of 2?

$$\lim_{x \rightarrow 2} \sqrt{3x-2} = 2$$

$$1.9 \leq \sqrt{3x-2} \leq 2.1$$



$$2-h \leq x \leq 2+h$$

$$a \leq x \leq b$$

$$a < 2 \quad 2 < b$$

$$1.87 \leq x \leq 2.14$$

$$1.9^2 \leq \sqrt{3x-2}^2 \leq 2.1^2$$

$$1.9^2 + 2 \leq 3x \leq 2.1^2 + 2$$

$$\frac{1.9^2 + 2}{3} \leq x \leq \frac{2.1^2 + 2}{3}$$

$$1.87 \leq x \leq 2.13667$$

Aug 30-8:26 PM

Sep 1-6:10 PM